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ABSTRACT

This document presents the results of a comprehensive study of post-doctoral education in Ontario. Some of the findings include: (1) almost 60% of the post-doctoral students were in the physical sciences, 21% in the life and health sciences, 15% in the mathematical sciences and engineering, and only 3.4% were studying in the humanities and social sciences; (2) for most of the post-doctoral students there was not significant lapse of time between receipt of the PhD and the commencement of the post-doctoral appointment; (3) about 26% of the Ontario post-doctoral students came from Asia, 25% from the United Kingdom, 19% from Europe, 12% from Canada, and 10% from the United States; (4) 89% of the post-doctoral students implied that research was their reason for accepting the appointment and 11% had taken the appointment as temporary employment; and (5) the average value of the annual stipend paid to post-doctoral students in 1969-70 was $7,335. (HS)

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POST-DOCTORAL EDUCATION IN THE ONTARIO UNIVERSITIES 1969-70

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by

L. C. PAYTON

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A Report Submitted to
the Council of Ontario Universities
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The views expressed herein are those of the author and do not necessarily represent those of the Council of Ontario Universities.

Summary

In February, 1970, CPUO requested its Research Division to undertake a study of post-doctoral education. An advisory committee, drawn from the membership of the Ontario Council on Graduate Studies, was set up to assist the Research Division in the development of the methodology to be employed in the study and in the design of the questionnaires to be sent to the universities. The questionnaires were sent out in June 1970 and all had been returned by the following December.

Questionnaires were completed by the chairman of those departments with post-doctoral students and by the post-doctoral students themselves. All post-doctoral students who had appointments falling within the period July 1, 1969, to June 30, 1970, were included in the study (with the exception of post-doctorals in the clinical departments in the Medical Sciences who were excluded from the study). Questionnaires were returned by 510 students.

In 1969-70 there were an estimated 622 post-doctoral students in 98 departments in thirteen Ontario universities (only Laurentian University indicated that it did not yet have post-doctoral students). Toronto alone had almost 30% of the total and McMaster, Queen's, Toronto and Western together accounted for two-thirds of the post-doctorals. An additional 14% were at Waterloo and York universities.

The six major OCGS discipline categories (with some required modifications), humanities and social sciences, physical sciences, mathematical sciences, engineering, life sciences and health sciences, are used in the study. Almost 60% of the post-doctoral students were in the physical sciences, 21% in the life and health sciences, and 15% in the mathematical sciences and engineering. Only 21 students (3.4% of the total) were studying in the humanities and social sciences.

For a large majority of the post-doctoral students, there was no significant lapse of time between receipt of the PhD and commencement of the post-doctoral appointment. Only 24% of the students indicated that they had had any previous post-doctoral experience.

Only 12% of the post-doctoral students who returned the questionnaire were Canadian citizens. A further 56% had landed immigrant status and the remaining 32% were classified as foreign. About 26% of the Ontario post-doctoral students came from Asia, 25% from the United Kingdom, 19% from Europe, 12% from Canada, and 10% from the United States. On the other hand, it is estimated that in 1969-70 there were two to three times as many Canadian post-doctoral students originally from Ontario holding appointments outside of Canada as there were Canadians engaged in post-doctoral studies in the Ontario universities. Statistics from NRC and OCGS are presented showing that the majority of PhD recipients from Canadian universities who went on to take post-doctoral appointments in 1969-70 did so at universities outside of Canada. This may not continue to be the case, however, for NRC has stipulated that 50% of its new post-doctorate fellowships awarded in 1971-72 must be held in Canada.

Research was specifically mentioned, or implied, as the reason for taking the present appointment by two-thirds of the post-doctoral students. A further 11% of the post-doctorals had taken the appointment as temporary employment.

The post-doctoral students indicated that a university or college was the preferred employment setting upon completion of their present appointments. In fact, nearly 59% of the post-doctorals who had terminated their appointments during 1969-70, had found a position in a university setting. Over 10% of the students had accepted another post-doctoral appointment. Nearly 41% of the post-doctoral students who had terminated their appointments in 1969-70 obtained a position in Canada.

Looking at the role of the post-doctoral student in the Ontario universities, it was seen that nearly 85% of the appointments lasted two years or less. Only about one-quarter of the post-doctoral students attended regular university courses and only 35% of the students were engaged in any instructional activities. Post-doctoral students on the average spent about 3.5 hours per week in contact with their mentors and 1.4 hours per week in contact with other academic staff.

In 1969-70 the average value of the annual stipend paid to post-doctoral students was $7,335. The average stipends ranged from a low of $7,209 in the physical sciences to a high of $8,633 in the humanities and social sciences. Nearly half of the monies paid in stipends came from NRC. The universities accounted for over 18% of the stipend monies and the only other major funding agency was the Medical Research Council which contributed about 9% of the total.

The operating costs associated with post-doctoral students were estimated (less the monetary value of the teaching service performed by the students). The net cost per student in 1969-70 was $10,452 of which 45.3% ($4,735) was contributed by the host university.

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Introduction

According to the National Research Council of Canada (NRC)[1] there were only 48 post-doctoral students in science and engineering departments (excluding medical schools) in Canadian universities in 1956. In 1968 the number of post-doctorals had grown to 974 and by 1972 it is expected that the figure will be 2206, an increase of 126% over the five-year period. Another study undertaken by NRC[2] showed that the Ontario universities accounted for 502 post-doctoral students in 1968-69 and are expected to have 907 in 1971-72, an increase of 81%. By way of comparison, in the same period, 1968-69 to 1971-72, full-time undergraduate enrolment in the Ontario universities is expected to have increased by 41% and full-time graduate enrolment by 40%[3]. On the other hand, the number of PhD degrees awarded during this same period is expected to increase by 121%[4]. It is somewhat surprising considering the rapid growth in the numbers of post-doctoral students that there is still very little known about them. Perhaps this is partly due to uncertainty as to their position in the university — should they be treated as students or as staff?

The first task in designing the study was to decide on the population to be covered. Two classes of post-PhD students were to be covered: those students designated as post-doctorals and those students designated as research associates. Research associates were defined to be those post-doctoral students being paid in full or in part from university operating funds, as opposed to those being paid solely from outside grants or funds. It was never intended that this categorization would necessarily be employed in any subsequent analysis but it was thought that the employment of this distinction in the questionnaires to the universities would ensure that the entire desired population was covered. Finally, it was decided that all post-doctorals, research associates, and graduate

fellows in the clinical departments in the Medical Sciences would be excluded from this study since it was thought that the duties of the post-PhD students in the clinical departments would not differ significantly from the duties of the post-MD students. Furthermore, only the fourteen provincially-assisted universities were included in this study; it was felt that no post-doctoral students would be missed because of this limitation.

A set of three questionnaires was prepared and sent out to the graduate dean at each university. The first questionnaire was to be completed by the chairmen or heads of those departments with post-doctoral students, and sought information of a general nature about the post-doctorals in the department. Information was also sought about the office and laboratory space that was being used by the post-doctoral students. These data were to be related to data concerning the whole university supplied by the physical plant department on the second questionnaire, in an attempt to attribute a portion of the physical plant operating expenditure to the post-doctoral students. On examination of the returns, however, these data were not found to be of uniform quality and an alternate method of allocating the physical plant costs was subsequently employed in the analysis. The third questionnaire, completed by each post-doctoral student, sought information on the student's prior education and background as well as the duties and activities associated with the present appointment. A set of the questionnaires is contained in Appendix A.

It was recognized during the design phase of the study that the post-doctoral student is highly mobile and may begin an appointment at any time during the year, and that the appointment itself may be of variable duration. For these reasons it was thought that a snapshot survey of those post-doctoral students in the Ontario universities on a particular date

would give misleading results. It was therefore decided that all post-doctoral students and research associates who had appointments falling within the period July 1, 1969, to June 30, 1970, should be included in the study.

After a preliminary study of the returns it seemed inappropriate to maintain the distinction between post-doctorals and research associates as they had been defined previously. The grants available to a department and the sources of these monies in many cases seem to be the factors in determining whether a post-PhD appointment will be categorized as a post-doctoral appointment or as a research associate appointment. Subsequent references to post-doctorals encompass all those post-PhD students having either a post-doctoral or a research associate appointment.

The report has been divided into three sections. Chapter 1 presents a demographic picture of the post-doctoral population in the Ontario universities. The distribution of the post-doctoral students among the universities is shown according to major fields of study; this is the only part of the report to show a breakout by university. Material is presented which details the time lapse between completion of doctoral work and the start of the present post-doctoral appointments, as well as any previous post-doctoral studies taken before the present appointment. A detailed analysis of the citizenship of the post-doctoral students is presented. From the questionnaires completed by the students themselves information is presented listing their reasons for doing post-doctoral studies and their desired employment upon completion of these studies. By way of comparison, from questions asked of the departmental chairmen, data show the actual employment obtained by the post-doctoral students who completed their studies during the period being investigated and the countries in which this employment was found.

Chapter 2 examines the role of the post-doctoral student in the university. Existing regulations regarding the duration of post-doctoral appointments are compared with the time actually spent during these appointments. The demands on the teaching resources of the university are shown, both the time spent in formal classroom instruction and the time spent in consultation with members of the academic staff. Post-doctoral students also serve as a teaching resource, and the extent to which they engage in teaching duties is examined. Finally, from the questionnaires completed by the departmental chairmen, subjective assessments are presented on the importance of post-doctoral work in hiring new staff and the rank at which prospective staff with the same academic credentials would have been hired.

Chapter 3 presents a picture of the financial resources that are consumed by post-doctoral students. The amounts of the stipends paid to post-doctorals and the sources of these stipends are detailed. By way of comparison, these stipends are compared to the salaries paid to the academic staff in the ranks at which prospective staff with the same qualifications as the post-doctorals would have been hired. The replacement costs of the teaching performed by the post-doctoral students are shown. Finally, estimates are made of the operating expenditures relating to post-doctoral education.

Chapter 1

The Demography of the Post-doctoral Population

A recent study of post-doctoral education in the United States[5] refers to this group as "the invisible university". This description of post-doctoral students seems most appropriate. It is generally thought that their primary function is to do research. Should they also be classed as students because they draw heavily on the teaching resources of the university? Or should they be described as members of the academic staff who have teaching commitments? In either case post-doctorals constitute a rapidly growing portion of the university population about which very little is known. In this first chapter we will examine where post-doctoral students are to be found in the Ontario system and some of the background characteristics of this group.

Distribution of Post-doctorals in the Ontario Universities

One of the difficulties in employing a questionnaire survey is that it is often impossible to estimate accurately the total size of the population being studied. Recognizing that some post-doctoral students who were present during the study period may have left their universities before our questionnaire could reach them, we asked the departmental chairmen to indicate the number of post-doctorals who were in their departments during the period in question. In some cases this was not done and we then had to rely on the number of individual returns received from that department. In a few cases the number of individual returns received exceeded the figure supplied by the departmental chairmen; in these cases the number of returns was used to arrive at the estimate of the total population.

TABLE 1

DISTRIBUTION OF POST-DOCTORAL STUDENTS BY UNIVERSITY
AND FIELD OF STUDY
(FIGURES IN PARENTHESES ARE PERCENTS)

	BRO	CAR	GUE	LAK	McM	OTT	QUE	TOR	TRE	WAT	WES	WIN	YOR	TOTAL	%
HUMANITIES AND SOCIAL SCIENCES		1 (4.8)			1 (4.8)		2 (9.5)	9 (42.8)			3 (14.3)		5 (23.8)	21 (100.0)	3.4
PHYSICAL SCIENCES	4 (1.1)	20 (5.6)	15 (4.2)	6 (1.7)	52 (14.6)	20 (5.6)	20 (5.6)	94 (26.1)	11 (3.1)	26 (7.3)	50 (14.1)	11 (3.1)	26 (7.3)	355 (100.0)	57.1
MATHEMATICAL SCIENCES		5 (11.6)		1 (2.3)	6 (14.0)		22 (51.2)	8 (18.6)			1 (2.3)			43 (100.0)	6.9
ENGINEERING					8 (11.3)	4 (5.6)	5 (7.0)	21 (29.6)		21 (29.6)	9 (12.7)	3 (4.2)		71 (100.0)	11.4
LIFE SCIENCES		5 (5.2)	9 (9.4)		16 (16.7)	6 (6.3)	10 (10.4)	30 (31.2)		2 (2.1)	13 (13.5)		5 (5.2)	96 (100.0)	15.4
HEALTH SCIENCES			2 (5.6)		1 (2.8)		3 (8.3)	22 (61.1)			8 (22.2)			36 (100.0)	5.8
TOTAL %	4 (0.6)	31 (5.0)	26 (4.2)	7 (1.1)	84 (13.5)	30 (4.8)	62 (10.0)	184 (29.6)	11 (1.8)	49 (7.9)	84 (13.5)	14 (2.3)	36 (5.8)	622 (100.0)	100.0

In this manner we estimate that in the academic year 1969-70 there were 622 post-doctoral students in 98 departments in thirteen Ontario universities. Of the fourteen provincially-assisted universities only Laurentian University indicated that it did not yet have post-doctoral students. Laurentian did add however that this would not likely be the case within one or two years.

There is a possibility that some post-doctoral students were counted twice in the estimates provided by the departmental chairmen. (This double-counting could have occurred if a post-doctoral student had terminated his appointment at one Ontario university during the study period and had immediately begun another appointment at a second Ontario university.) There is no direct evidence that any double-counting did take place but, based on the post-doctoral questionnaire returns, perhaps a dozen or so students may have been counted twice. As correspondence with the graduate deans of the universities indicated that one or two smaller departments did not reply to our study questionnaires, it is felt that the 622 figure is a reasonable estimate of the number of post-doctoral students in the Ontario universities in 1969-70.

The six major OCGS discipline categories, with some required modifications, are used through this study. The major discipline areas and the departments within each category which responded to the survey are shown in Appendix B.

Table 1 shows the distribution of the 622 post-doctoral students among the thirteen universities in the six major discipline areas. Looking at the totals for the universities, it is not surprising to see that the bulk of the post-doctoral students were at the larger well-established universities. Toronto alone had almost 30% of the total and McMaster, Queen's, Toronto and Western together accounted for two-thirds of the post-doctorals in Ontario universities. Waterloo and York, while relatively new universities, are two of the larger universities in the province and accounted for an additional 14%.

TABLE 2

DISTRIBUTION OF POST-DOCTORAL STUDENT QUESTIONNAIRE RETURNS

BY UNIVERSITY AND FIELD OF STUDY

(FIGURES IN PARENTHESES ARE PERCENTS)

	BRO	CAR	GUE	LAK	McM	OTT	QUE	TOR	TRE	WAT	WES	WIN	YOR	TOTAL	%
HUMANITIES AND SOCIAL SCIENCES		1 (6.7)			1 (6.7)		2 (13.3)	8 (53.3)			2 (13.3)		1 (6.7)	15 (100.0)	2.9
PHYSICAL SCIENCES	4 (1.4)	20 (6.9)	13 (4.5)	5 (1.7)	48 (16.5)	17 (5.8)	10 (3.4)	62 (21.3)	10 (3.4)	16 (5.5)	50 (17.2)	11 (3.8)	25 (8.6)	291 (100.0)	57.1
MATHEMATICAL SCIENCES		5 (17.9)			6 (21.4)		10 (35.7)	6 (21.4)			1 (3.6)			28 (100.0)	5.5
ENGINEERING					8 (13.5)	4 (6.8)	5 (8.5)	20 (33.9)		10 (16.9)	9 (15.3)	3 (5.1)		59 (100.0)	11.6
LIFE SCIENCES		5 (6.1)	9 (11.0)		14 (17.1)	6 (7.3)	6 (7.3)	22 (26.8)		2 (2.4)	13 (15.9)		5 (6.1)	82 (100.0)	16.1
HEALTH SCIENCES			2 (5.7)		1 (2.8)		3 (8.6)	21 (60.0)			8 (22.9)			35 (100.0)	6.9
TOTAL %	4 (0.8)	31 (6.1)	24 (4.7)	5 (1.0)	78 (15.3)	27 (5.3)	36 (7.0)	139 (27.2)	10 (2.0)	28 (5.5)	83 (16.3)	14 (2.7)	31 (6.1)	510 (100.0)	100.0

Over 80% of the post-doctoral students were found at the above six universities.

The discipline totals reveal that almost 60% of the post-doctoral students were in the physical sciences. The physical sciences together with the mathematical sciences and engineering accounted for about 75% of the total while the life sciences and health sciences accounted for another 21%. Only twenty-one students (3.4% of the total) were studying in the humanities and social sciences. A possible explanation for this has been suggested in "The Invisible University." The authors found that the reason most often quoted for taking post-doctoral appointments in the United States was that recent doctoral graduates did not feel that they were prepared academically to become professors. A group of terminal-year graduate students were surveyed and about half were anticipating a post-doctoral appointment. Those planning post-doctoral work had all been assigned their theses projects by their advisors and were mainly in the more mathematically complex sciences.[6] On the other hand, "the PhD degree program provides the young humanist with a reasonably good introduction to the methods and resources that he must use in his scholarly research."[7]

A number of the tables in the sections that follow are based on the questionnaires returned by the post-doctoral students themselves. Table 2 shows the distribution among universities and discipline areas of the 510 students who completed the questionnaire. These students represent about 82% of the estimated post-doctoral population and therefore some differences can be expected in the percentage breakouts in Tables 1 and 2. However, the percentage breakouts for the row and column totals of Table 2 differ only slightly from those of Table 1; the preceding general observations applying to Table 1 are also valid for Table 2.

TABLE 3

DISTRIBUTION OF POST-DOCTORAL RETURNS BY YEAR IN WHICH
PhD WAS OBTAINED AND FIELD OF STUDY
(FIGURES IN PARENTHESES ARE PERCENTS)

CALENDAR YEAR IN WHICH PhD WAS OBTAINED

	BEFORE 1965	1965	1966	1967	1968	1969	1970	SUBTOTAL	NO RESPONSE	TOTAL
HUMANITIES AND SOCIAL SCIENCES	2 (13.3)				4 (26.7)	4 (26.7)	5 (33.3)	15 (100.0)		15
PHYSICAL SCIENCES	23 (8.0)	20 (7.0)	16 (5.6)	44 (15.4)	60 (21.0)	96 (33.6)	27 (9.4)	286 (100.0)	5	291
MATHEMATICAL SCIENCES	2 (7.1)	2 (7.1)	2 (7.1)	2 (7.1)	7 (25.0)	10 (35.7)	3 (10.7)	28 (100.0)		28
ENGINEERING	5 (9.1)	2 (3.6)	6 (10.9)	3 (5.5)	17 (30.9)	13 (23.6)	9 (16.4)	55 (100.0)	4	59
LIFE SCIENCES	9 (11.1)	4 (4.9)	5 (6.2)	8 (9.9)	18 (22.2)	27 (33.3)	10 (12.3)	81 (100.0)	1	82
HEALTH SCIENCES	4 (11.4)	1 (2.9)		6 (17.1)	6 (17.1)	14 (40.0)	4 (11.4)	35 (100.0)		35
TOTAL %	45 (9.0)	29 (5.8)	29 (5.8)	63 (12.6)	112 (22.4)	164 (32.8)	58 (11.6)	500 (100.0)	10	510

Time Between Completion of Doctoral Studies and Commencement of Post-doctoral Appointment

The post-doctoral students indicated on their questionnaires the year in which they had received the PhD degree (this may not always coincide with the date of completion of the degree requirements). The responses have been tabulated according to discipline areas in Table 3. Only ten of the 510 post-doctoral students who returned their questionnaires failed to answer this question; percentages have been calculated on the basis of those students who replied to this question. The year in which the degree was received refers to the calendar year, so it is possible for a post-doctoral student to have received his PhD degree in 1970 and still have begun his post-doctoral appointment in the academic year 1969-70.

Looking at the year in which the PhD was obtained for all the post-doctoral students, it can be seen that nearly one-third received their degree in 1969. Over 22% obtained their PhD in the previous year and a further 13% in 1967. Almost 12% of the post-doctorals did not obtain their degree until 1970. Of the post-doctoral students holding appointments in the academic year 1969-70, almost 80% had received their doctoral degree after 1966. Nearly half of the remaining 20% received their PhD degree prior to 1965.

There are, however, some deviations in this pattern among the discipline areas. Humanities and social sciences and health sciences show only 13 to 14% of their post-doctoral students having received their degrees prior to 1967. On the other hand, nearly 24% of the post-doctorals in engineering received their doctorates before 1967, followed by the life sciences with 22%. The largest group of post-doctoral students obtained their PhD degree in 1969 in all but two discipline areas. In the humanities and social sciences the largest group received their degree in 1970 (one-third of the total reported) while in engineering the largest group received their doctorate in 1968 (31%).

TABLE 4

DISTRIBUTION OF POST-DOCTORAL RETURNS BY
PREVIOUS POST-DOCTORAL EXPERIENCE AND FIELD OF STUDY
(FIGURES IN PARENTHESES ARE PERCENTS)

	PREVIOUS POST-DOCTORAL EXPERIENCE (MONTHS)														
	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37 +	TOTAL
HUMANITIES AND SOCIAL SCIENCES	13 (86.7)				2 (13.3)										15 (100.0)
PHYSICAL SCIENCES	215 (73.9)		2 (0.7)	2 (0.7)	29 (10.0)	2 (0.7)	2 (0.7)		26 (8.9)	1 (0.3)	1 (0.3)		6 (2.1)	5 (1.7)	291 (100.0)
MATHEMATICAL SCIENCES	21 (75.0)		1 (3.6)		3 (10.7)				2 (7.1)					1 (3.6)	28 (100.0)
ENGINEERING	52 (88.1)		1 (1.7)		3 (5.1)		1 (1.7)				1 (1.7)		1 (1.7)		59 (100.0)
LIFE SCIENCES	59 (72.0)	1 (1.2)	3 (3.7)	2 (2.4)	2 (2.4)			1 (1.2)	6 (7.3)				4 (4.9)	4 (4.9)	82 (100.0)
HEALTH SCIENCES	26 (74.3)			1 (2.8)	5 (14.3)									3 (8.6)	35 (100.0)
TOTAL	386 (75.7)	1 (0.2)	7 (1.4)	5 (1.0)	44 (8.6)	2 (0.4)	3 (0.6)	1 (0.2)	34 (6.7)	1 (0.2)	2 (0.4)		11 (2.1)	13 (2.5)	510 (100.0)

In general, it would appear that for a large majority of the post-doctoral students there is not a significant lapse of time between receipt of the PhD degree and the commencement of the post-doctoral appointment.

Previous Post-doctoral Experience

Since a large number of recent doctorate recipients have thought it necessary to continue their education and training by taking a post-doctoral appointment, the duration of this period of additional study is of considerable interest. There are two components of the length of time devoted to post-doctorate study; the duration of the present appointment and the period of time spent in post-doctoral work previous to acceptance of the present appointment. An examination of the length of time spent during the present appointment will be dealt with in the next chapter.

One of the questions on the post-doctoral questionnaire asked the respondents to list all of their previous post-doctoral studies. This required a subjective judgement on the part of the respondents and as a result some appointments which would not really be considered as post-doctoral studies may have been included in the returns. The results, tabulated by discipline area, are presented in Table 4.

Examination of the figures for all post-doctoral students shows that almost 76% had no post-doctorate studies prior to the present appointment. Nearly 9% indicated that they had about one year of previous study and 11% had one year or less. It should be mentioned that some of the respondents who indicated only a few months of previous post-doctoral study may have been extending an area of their doctoral research or may have been preparing their PhD dissertation for publication. An additional 7% had about two years previous post-PhD work, 2% had about three years, and roughly 3% had more than three years.

Looking at the differences among the discipline areas, engineering shows the greatest percentage of students with no previous post-doctoral

TABLE 5

DISTRIBUTION OF POST-DOCTORAL RETURNS BY
CITIZENSHIP STATUS, COUNTRY OF CITIZENSHIP AND FIELD OF STUDY
(FIGURES IN PARENTHESES ARE PERCENTS)

	CITIZENSHIP STATUS AND COUNTRY OF CITIZENSHIP														
	CANADA	LANDED IMMIGRANT							FOREIGN						
		USA	UK	EUROPE	ASIA	AFRICA	OTHER	SUB-TOTAL	USA	UK	EUROPE	ASIA	AFRICA	OTHER	SUB-TOTAL	TOTAL
HUMANITIES AND SOCIAL SCIENCES	3 (20.0)	2 (13.3)	1 (6.7)				1 (6.7)	4 (26.7)	2 (13.3)	3 (20.0)	1 (6.7)	1 (6.7)	1 (6.6)		8 (53.3)	15 (100.0)
PHYSICAL SCIENCES	29 (10.0)	11 (3.8)	80 (27.5)	33 (11.3)	38 (13.1)	3 (1.0)	7 (2.4)	172 (59.1)	15 (5.2)	8 (2.7)	23 (7.9)	38 (13.1)	3 (1.0)	3 (1.0)	90 (30.9)	291 (100.0)
MATHEMATICAL SCIENCES	5 (17.9)	1 (3.6)	2 (7.1)	1 (3.6)	3 (10.7)	1 (3.6)	2 (7.1)	10 (35.7)	1 (3.6)	4 (14.2)	2 (7.1)	6 (21.4)			13 (46.4)	28 (100.0)
ENGINEERING	6 (10.2)		11 (18.6)	8 (13.6)	9 (15.2)	1 (1.7)	2 (3.4)	31 (52.5)		1 (1.7)	13 (22.0)	5 (8.5)	1 (1.7)	2 (3.4)	22 (37.3)	59 (100.0)
LIFE SCIENCES	15 (18.3)	8 (9.8)	11 (13.4)	6 (7.3)	21 (25.6)	2 (2.4)	1 (1.2)	49 (59.7)	5 (6.1)	1 (1.2)	5 (6.1)	5 (6.1)	1 (1.2)	1 (1.2)	18 (21.9)	82 (100.0)
HEALTH SCIENCES	4 (11.4)	6 (17.1)	5 (14.3)	1 (2.9)	6 (17.1)		2 (5.7)	20 (57.1)	2 (5.7)	2 (5.7)	3 (8.6)	2 (5.7)		2 (5.7)	11 (31.4)	35 (100.0)
TOTAL	62 (12.1)	28 (5.5)	110 (21.6)	49 (9.6)	77 (15.1)	7 (1.4)	15 (2.9)	286 (56.1)	25 (4.9)	19 (3.7)	47 (9.2)	57 (11.2)	6 (1.2)	8 (1.6)	162 (31.8)	510 (100.0)

experience (88%) followed by the humanities and social sciences with 87%. The life sciences record the lowest percentage at 72% and then the physical sciences with 74%. Only two post-doctoral students (13% of the total) in the humanities and social sciences had previous experience, in these cases about one year. In both the mathematical sciences and engineering four students had up to a year of post-PhD studies and three others had more. In the health sciences 17% of the post-doctorals had up to one year of previous study and a further 9% had more than three years. In the remaining discipline areas, a more uniform distribution is evident for those students who had prior experience.

In summary, a large proportion of the post-doctoral students have had no post-doctoral experience prior to the present appointment.

Citizenship of the Post-doctoral Students

We have seen over the past few years increasing concern over the number of non-Canadian professors and graduate students in the Ontario universities. It therefore seems appropriate to examine the citizenship of the post-doctorals who are studying in Ontario universities. On the post-doctoral questionnaire the students were asked to indicate their country of citizenship, and in the case of non-Canadians, their visa status in Canada. The resulting tabulation is presented in Table 5.

Only 12% of the post-doctoral students who returned the questionnaire were Canadian citizens. A further 56% had landed immigrant visa status and the remaining 32% were classified as foreign. The physical sciences and engineering had the lowest Canadian content (10% of the total in these disciplines) while the life sciences and the humanities and social sciences had the greatest proportion of Canadians with 18 and 20% respectively.

By far the greatest number of landed immigrants were from the United Kingdom (22% of all post-doctoral students) followed by Asia and then Europe (15 and 10% respectively). Landed immigrants accounted for about 27%

of all humanities and social sciences post-doctorals and for 36% of the students in the mathematical sciences. In the remaining discipline areas 50 to 60% of the post-doctorals were in the landed immigrant category.

Of the 32% of the post-doctoral students who were classified as foreign, the largest representation was from Asia (11% of the total) followed by Europe with 9% and the United States with 5% of the post-doctoral student population. Life sciences had the lowest foreign content at 22% and foreign students accounted for about 31% of the post-doctorals in the physical sciences and the health sciences. Humanities and social sciences had the highest foreign content at 53% of the total.

By way of comparison, in 1969-70, 53% of Ontario full-time doctoral students were Canadian, 28% were landed immigrant, and 19% were foreign. The corresponding figures for masters students are 69%, 16% and 15% respectively.[8]

Examining the origins of the Ontario post-doctoral students we see that the largest group came from Asia (26% of the total). The United Kingdom is next with 25% of the total, followed by Europe with 19%, Canada with 12% and the United States with 10% of the total. The remaining 7% came from Africa and other areas of the world not included in the previously mentioned geographic areas.

These figures would seem to indicate that Ontario universities share in the reputation of North American universities as being excellent centres for the continuation of higher education. Coupled with this is the fact that funds are now more readily available for post-doctoral studies in these institutions. The above observations are particularly relevant to American institutions but a somewhat similar situation appears to exist in Ontario. If large numbers of foreign doctoral graduates are choosing Ontario universities for their post-doctoral work, are significant numbers of Canadian PhD

holders from the Ontario universities going out of the country for their further studies?

In the past, many Canadian students have studied in universities in the United Kingdom, in Europe, and in the United States. While no hard data are available on the numbers of Canadian post-doctorals abroad, it has been estimated that in 1969-70 there were two to three times as many Canadian post-doctoral students originally from Ontario holding appointments outside of Canada as there were Canadians engaged in post-doctoral studies in the Ontario universities.[9] An estimated one-quarter of these students received their doctorates from non-Canadian universities and could perhaps be expected to take their post-doctoral training outside of Canada. However, it is obvious that a majority of Canadians receiving their PhDs from Canadian universities and taking post-doctoral appointments upon graduation also elected to hold these appointments abroad.

This is not unexpected when one considers that many of these students wish to broaden their experiences by seeking post-doctoral positions in prestige institutions abroad. Moreover, NRC's granting policy in 1969-70 stipulated that recipients of NRC post-doctorate fellowships were free to hold their awards at either Canadian or foreign institutions.[10] Statistics published by NRC show that in 1969-70 there were 220 post-doctoral fellowships awarded by NRC. About 88% of these awards went to students who had received their PhD from a Canadian university. It is interesting to note that only 34 (15.5%) of the 220 awards were held at Canadian universities. A further 19% of the awards were held at American universities, 33% at universities in the United Kingdom, 27% at European institutions, 3% at universities in Asia, and 3% at other universities. Almost half of the fellowships held in 1969-70 were new awards; 13.5% of these were held at Canadian universities.[11] In 1970-71, 37% of the 110 new NRC awards were

for tenure in Canadian universities. For 1971-72, NRC decided to increase the number of new awards to 150 and stipulated that at least 50% of these new awards must be held in Canada.[12] This change in policy is certain to increase the proportion of Canadian post-doctoral students at Canadian universities.

Somewhat similar findings have been presented for Ontario by OCGS. During the period 1964-69[13] 371 PhDs accepted post-doctoral appointments as their immediate post-graduation employment. This figure represented 24.5% of the PhD graduates whose immediate employment plans were known. Of the 371 post-doctoral fellowships accepted, 101 (27.2%) were held at Canadian universities. The study also showed that 63% of the graduating PhDs held Canadian citizenship upon graduation. Applying this percentage, we would estimate that 64 (17.3%) of the post-doctoral fellowships were held by Canadians at Canadian universities. A follow-up study covering the convocations of Autumn, 1969 through Spring, 1970, was undertaken by OCGS.[14] This study showed that 169 graduating PhDs (27.9% of the graduates whose employment plans were known) accepted post-doctoral fellowships. Of these awards, 83 (49.1%) were held at Canadian universities. Again assuming that 63% of the graduating PhDs were Canadians, we would estimate that 52 (30.7%) of the post-doctoral appointments were held by Canadian citizens at Canadian universities.

The above statistics would clearly seem to indicate that in 1969-70 the majority of Canadians went abroad for their post-doctoral studies.

To place the preceding statistics in their proper perspective, we should consider the statement of OCGS relating to the international exchange of students at the post-doctoral level:

Faculties and Schools of Graduate Studies have always drawn upon the international community of scholars for staff and students. The relative proportions of native and foreign persons in each university's graduate endeavours depend upon the attractiveness of the environment in terms of scholarly reputation and financial support. Prior to 1967, when there were few large and well known graduate schools in Canada, the foreign component of staff and students was small; many Canadians went abroad for graduate and post-doctoral study. Since 1967 there has been a marked change. The rapid growth of the older graduate schools in terms of material and human resources and the establishment of graduate programs in the newer universities have made Ontario a most attractive location for scholars from many countries.

In essence, in the fields of graduate and post-doctoral education, Canada now plays the role for developing nations formerly played by Europe and the United States for Canadian students. At the same time, the Canadian graduate schools have become more attractive to Canadian students for doctoral studies. However, it is natural that many of the new Canadian PhDs, educated in Canada, should wish to sample the environment of a foreign institution and thereby to broaden their experience, as is the practice in other developed nations.

The extent to which the non-Canadian portion of our post-doctoral population is offset by Canadians undertaking post-doctoral study abroad is not easily determined. Statistical data from Britain and the United States regarding Canadian post-doctoral residents are not available and our own internal data collection has not been directed to this end in the past. Nevertheless, it is likely that recent changes in the condition of support for post-doctoral studies from Canadian sources, and the continued growth of our graduate schools on the international scene, will produce a situation in which the foreign complement of post-doctoral students in Ontario will be balanced by the complement of Canadians engaged in post-doctoral studies abroad and by an increasing fraction of Canadian PhDs that remain in Canada for further study.

In summary, it appears that we are witnessing the development of our graduate schools into full-fledged internationally recognized institutions that play an important part in the education of Canadian and foreign post-doctoral students on the same basis as institutions in other developed nations. Recognition of this development is first made by scholars from developing countries and secondly by our own products. As the second recognition becomes more widespread, the balance of native and foreign complements will approach the international norms.

Reasons for Taking Post-Doctoral Studies

We have seen that a large number of doctorate holders have decided that their education was still not complete upon receipt of the PhD degree and have taken post-doctoral appointments. In this section we shall examine some of the reasons for this decision.

REASONS FOR TAKING THE PRESENT POST-DOCTORAL APPOINTMENT

AS REPORTED BY THE POST-DOCTORAL STUDENTS

(FIGURES IN PARENTHESES ARE PERCENTS)

	HUMANITIES & SOCIAL SCIENCES	PHYSICAL SCIENCES	MATHEMATICAL SCIENCES	ENGINEERING	LIFE SCIENCES	HEALTH SCIENCES	TOTAL
To Gain Further Research Experience & Training		70 (25.6)	3 (10.7)	10 (18.5)	27 (34.6)	14 (41.1)	124 (25.7)
To Gain (Research) Experience at Other Centres	2 (13.3)	35 (12.8)	4 (14.3)	8 (14.8)	6 (7.7)	3 (8.8)	58 (12.0)
Temporary Employment	2 (13.3)	37 (13.6)	3 (10.7)	7 (13.0)	5 (6.4)	1 (2.9)	55 (11.4)
To do Research in a Particular Field	2 (13.3)	20 (7.3)	3 (10.7)	3 (5.5)	10 (12.8)	4 (11.8)	42 (8.7)
To Gain (Research) Experience in Other Fields	2 (13.3)	27 (9.9)		7 (13.0)	4 (5.1)	1 (2.9)	41 (8.5)
Credentials for Future Academic Employment		26 (9.5)		3 (5.5)	4 (5.1)	3 (8.8)	36 (7.5)
Further Study		13 (4.8)	3 (10.7)	3 (5.5)	8 (10.3)	2 (5.9)	29 (6.0)
Interest in Doing Research		10 (3.7)	4 (14.3)	4 (7.4)	7 (9.0)	1 (2.9)	26 (5.4)
Research with Few Outside Responsibilities		6 (2.2)	7 (25.0)		3 (3.8)	1 (2.9)	17 (3.5)
To Continue PhD Research	3 (20.0)	6 (2.2)		3 (5.5)		2 (5.9)	14 (2.9)
Other	4 (26.7)	23 (8.4)	1 (3.6)	6 (11.1)	4 (5.1)	2 (5.9)	40 (8.3)
Total	15 (100.0)	273 (100.0)	28 (100.0)	54 (100.0)	78 (100.0)	34 (100.0)	482 (100.0)

On the questionnaire sent to the post-doctoral students, they were asked to state their reasons for accepting the present appointment. No categories were provided and the respondents were free to list any reasons they chose. However, a preliminary examination of the returns showed that the majority of the responses fell into a small set of categories. The returns were then examined again and the responses classified according to these categories. Some of the categories seem to be closely related but the distinctions were maintained in order to reflect the actual wording found in the responses. It was necessary on occasion however to employ a subjective judgement in the classification. Of the 510 returns received, this question had been answered by 482 students. The resulting tabulation is presented in Table 6.

Research was specifically mentioned, or implied, as the reason for taking the present appointment by two-thirds of the post-doctoral students. In many cases, however, this was qualified in some manner. The most often quoted reason (26% of the total) was to gain further research experience and training. About 41% of the post-doctorals in the health sciences gave this reason and 35% of the students in the life sciences. Almost 9% of the post-doctoral students indicated a desire to do research in a particular field. A further 3% wished to continue research begun during their doctoral studies. Exactly 8.5% of the post-doctorals wished to gain research experience in other fields and 12% of the total desired to see how research was conducted at an institution different from the one in which the doctoral research was undertaken. Exactly 3.5% were seeking an opportunity to do research away from the outside responsibilities that would be present in a teaching position. Almost 5.5% indicated a general interest in doing research

Over 11% of the post-doctorals who answered this question stated that they had taken the present appointment as temporary employment. In many

TABLE 7

ORGANIZATIONS IN WHICH EMPLOYMENT IS DESIRED UPON COMPLETION OF POST-DOCTORAL STUDIES

(FIGURES IN PARENTHESES ARE PERCENTS)

	UNIVERSITY OR COLLEGE	BUSINESS OR INDUSTRY	FEDERAL OR PROVINCIAL GOVERNMENT	NON-PROFIT ORGANIZATION	SELF-EMPLOYMENT	OTHER	TOTAL
HUMANITIES AND SOCIAL SCIENCES	14 (77.8)	1 (5.6)	1 (5.6)			2 (11.1)	18 (100.0)
PHYSICAL SCIENCES	228 (48.3)	104 (22.0)	80 (16.9)	32 (6.8)	8 (1.7)	20 (4.2)	472 (100.0)
MATHEMATICAL SCIENCES	25 (86.2)	3 (10.3)	1 (3.5)				29 (100.0)
ENGINEERING	37 (43.0)	24 (27.9)	10 (11.6)	8 (9.3)		7 (8.1)	86 (100.0)
LIFE SCIENCES	70 (56.4)	11 (8.9)	25 (20.2)	11 (8.9)		7 (5.6)	124 (100.0)
HEALTH SCIENCES	31 (60.8)	5 (9.8)	7 (13.7)	4 (7.8)	1 (2.0)	3 (5.9)	51 (100.0)
TOTAL	405 (51.9)	148 (19.0)	124 (15.9)	55 (7.1)	9 (1.2)	39 (5.0)	780 (100.0)

cases they stated that they had been unable to obtain a more attractive offer and were waiting for an interesting position to become available. This situation is not surprising since at this time Canada was beginning to experience a period of high unemployment. At the same time the Ontario universities were being constrained to limit the numbers of new staff being hired.

Exactly 7.5% of the post-doctoral students stated that their appointment had been taken to provide the necessary credentials for future academic employment. This category would show a much higher percentage if one considered that many of the students who indicated research were in fact seeking to improve their chances for future academic employment. A further 6% indicated an interest in continuing their studies and over 8% of the post-doctorals listed a variety of other reasons for accepting their present positions.

The reason for so many post-doctoral students seeking to improve their research abilities will be looked at in the next section.

Where the Post-doctorals Hope to Find Employment

The post-doctoral students were asked to indicate on their questionnaires where they hoped to be employed upon completion of their studies. They were asked to select from the following six categories: university or college, business or industry, federal or provincial government, non-profit organization, self-employment or other. The students were free to check any number of these categories and a total of 780 responses were given; the results are presented in Table 7.

Almost 52% of the responses indicated university or college as the place of employment desired. It is likely that this percentage is low as many of the post-doctoral students who would prefer to be employed in a university or college will probably have also indicated some of the other categories as secondary choices. This would increase the totals in these other categories and tend to distort the results somewhat. The fact that so

many post-doctorals are seeking placement in the university setting clearly demonstrates why so many listed research as their reason for taking a post-doctoral appointment. Clearly, research is viewed as an important activity in the role of a university professor. Exactly 19% of the total responses listed business or industry, another 16% indicated federal or provincial government, and a further 7% listed non-profit organizations.

There were differences in the response patterns for the individual discipline areas. Over 86% of the responses in the mathematical sciences were in the university or college category, by far the highest of any discipline group. The majority of the remaining responses in the mathematical sciences were in business or industry. The humanities and social sciences had the next highest percentage of responses in the university or college category (78%) followed by the health sciences with 61%. Not surprisingly, only 43% of the responses in engineering were in this category and 48% of the responses in the physical sciences. As could be expected, a significant percentage of the responses in engineering were in the business or industry category (28%). Exactly 22% of the responses in the physical sciences were in this category but no other discipline area had more than a 10% response in the category. In the federal or provincial government category, the highest percentage of responses was in the life sciences (20%), followed by the physical sciences with 17%. Approximately 7 to 9% of the responses in the physical sciences, engineering, the life sciences and the health sciences were in the non-profit organization category. Only nine responses (eight in the physical sciences and one in the health sciences) were listed under self-employment.

Where the Post-doctoral Students Actually Found Employment

The departmental chairmen were asked to indicate the organizations in which employment was found by those post-doctoral students who had terminated their appointments during the academic year 1969-70. A list of categories

TABLE 8

ORGANIZATIONS IN WHICH EMPLOYMENT WAS OBTAINED UPON
COMPLETION OF PRESENT POST-DOCTORAL APPOINTMENTS
(FIGURES IN PARENTHESES ARE PERCENTS)

	UNIVERSITY OR COLLEGE	BUSINESS OR INDUSTRY	FEDERAL OR PROVINCIAL GOVERNMENT	NON-PROFIT ORGANIZATION	SELF-EMPLOYMENT	POST-DOCTORAL WORK	NOT KNOWN	TOTAL
HUMANITIES AND SOCIAL SCIENCES	11 (68.7)		1 (6.3)	2 (12.5)		2 (12.5)		16 (100.0)
PHYSICAL SCIENCES	115 (61.5)	26 (13.9)	16 (8.6)			15 (8.0)	15 (8.0)	187 (100.0)
MATHEMATICAL SCIENCES	25 (78.1)	3 (9.4)				3 (9.4)	1 (3.1)	32 (100.0)
ENGINEERING	13 (46.4)	5 (17.9)	1 (3.6)			4 (14.3)	5 (17.9)	28 (100.0)
LIFE SCIENCES	18 (43.9)	4 (9.8)	6 (14.6)		2 (4.9)	8 (19.5)	3 (7.3)	41 (100.0)
HEALTH SCIENCES	3 (25.0)	1 (8.3)	1 (8.3)	3 (25.0)	1 (8.3)	1 (8.3)	2 (16.7)	12 (100.0)
TOTAL	185 (58.5)	39 (12.3)	25 (7.9)	5 (1.6)	3 (1.0)	33 (10.4)	26 (8.2)	316 (100.0)

was provided on the questionnaire sent to each department. A tabulation of the responses is presented in Table 8.

Of the 316 post-doctoral students reported by the departmental chairmen, nearly 59% found employment in a university or college. As could be expected after examining Table 7, the disciplines with the highest percentage of their terminating post-doctorals in this category were the mathematical sciences (78%) and the humanities and social sciences (69%). Interestingly, only 25% of the students in the health sciences and 44% of those in the life sciences were indicated as having found employment in a university or college, considerably lower than the expectations of the students in these disciplines. Over 46% of the students in engineering found employment in the university setting, which was slightly above expectation, and the physical sciences were significantly above expectation with almost 62% obtaining employment in a university or college.

These percentages may reflect a downward bias because over 10% of the post-doctorals who were reported have taken another post-doctoral appointment. The discipline percentages range from 8% in the physical sciences to a high of almost 20% in the life sciences. It seems reasonable to expect that a majority of this group of students will ultimately find a position in a university or college. In Table 6 it was seen that 11% of the post-doctoral students in 1969-70 had taken their appointments as temporary employment after they were unable to find permanent positions that met their expectations. Probably the 10% of the reported terminating post-doctorals who accepted a further post-doctoral appointment did so for similar reasons. Almost 69% of the post-doctoral students have therefore remained in a university setting.

The percentages of the terminating students who obtained positions in the other categories of employment are considerably below the expected values. However, the distribution patterns within each category among the various disciplines are somewhat similar to the patterns in Table 7.

Country in Which Employment Was Obtained

In Table 5 it was observed that only 12% of the post-doctoral students in the Ontario universities in 1969-70 were Canadian, and that a further 56% held landed immigrant status. The ultimate destination of these landed immigrants is important because if a large proportion remains in Canada the country will benefit by the addition of these highly qualified people. One must also remember that a considerable benefit will be realized if many of the landed immigrant and foreign students return to their home countries. The departmental chairmen were asked to indicate the countries in which their terminating post-doctorals found employment; the results are shown in Table 9.

Nearly 41% of the post-doctoral students who terminated their appointments in 1969-70 obtained a position in Canada. If we consider the hypothetical case that all of the Canadian post-doctorals remained in Canada and all of the foreign post-doctorals did not stay, then about half of the landed immigrant students would have found employment in Canada. It is highly likely however that some of the Canadians took positions elsewhere while some of the foreign students remained in Canada. Almost 18% of the terminating post-doctoral students accepted employment in the United States, 14% in Europe, 12% in the United Kingdom, and about 7% in Asia.

Exactly 75% of the terminating post-doctoral students in the humanities and social sciences remained in Canada, by far the highest percentage in any discipline area. In the life sciences and the health sciences respectively, 45% and 47% of the students stayed in the country and 37 to 39% of the students in the mathematical and physical sciences and engineering took positions in Canada. The life sciences recorded the highest percentage of students taking employment in the United States (one-quarter of the total in this discipline) while engineering was the lowest with 7%. The

TABLE 9

COUNTRY OF EMPLOYMENT UPON COMPLETION
OF POST-DOCTORAL APPOINTMENT
(FIGURES IN PARENTHESES ARE PERCENTS)

	CANADA	USA	UK	EUROPE	ASIA	AFRICA	OTHER	NOT KNOWN	TOTAL
HUMANITIES AND SOCIAL SCIENCES	12 (75.0)	2 (12.5)	1 (6.3)				1 (6.3)		16 (100.0)
PHYSICAL SCIENCES	70 (36.8)	36 (18.9)	28 (14.7)	27 (14.2)	14 (7.4)	3 (1.6)	10 (5.3)	2 (1.1)	190 (100.0)
MATHEMATICAL SCIENCES	12 (38.7)	4 (12.9)	5 (16.1)	5 (16.1)	2 (6.5)		1 (3.2)	2 (6.5)	31 (100.0)
ENGINEERING	11 (39.3)	2 (7.1)	1 (3.6)	6 (21.4)	3 (10.7)	1 (3.6)	3 (10.7)	1 (3.6)	28 (100.0)
LIFE SCIENCES	18 (45.0)	10 (25.0)	2 (5.0)	5 (12.5)	3 (7.5)		1 (2.5)	1 (2.5)	40 (100.0)
HEALTH SCIENCES	8 (47.1)	3 (17.6)	1 (5.9)	2 (11.8)	1 (5.9)			2 (11.8)	17 (100.0)
TOTAL	131 (40.7)	57 (17.7)	38 (11.8)	45 (14.0)	23 (7.1)	4 (1.2)	16 (5.0)	8 (2.5)	322 (100.0)

mathematical sciences had the highest percentage going to the United Kingdom (16%) and again engineering was lowest with 3.6%. However, engineering showed by far the highest percentage of students taking positions in Europe and Asia.

In this chapter we have dealt with the characteristics and background of the post-doctoral population. In Chapter 2 we will examine the role of the post-doctoral student in the Ontario universities.

Chapter 2

The Post-doctoral Student in the Ontario University

We have seen in the previous chapter that an increasing number of newly-minted PhDs feel it is essential to continue their education, via a post-doctoral appointment, if they are to obtain a suitable academic position. Furthermore, they appear to be highly motivated towards research. In this chapter we will examine the realities of the post-doctoral's position in the university.

Time Limits on Appointments

Given that a large number of doctorate recipients believe that it is necessary to engage in post-doctoral studies, one may then ask what length of time should be spent on these studies. Perhaps the best indication of this can be obtained from an examination of the durations of the appointments of the post-doctoral students in the universities; this will be undertaken in the next section. But another source of information that should be looked at is the set of existing rules that the universities use to regulate post-doctoral appointments. The departmental chairmen were asked to indicate how long post-doctoral students could remain in their departments. Table 10 presents the responses to this question.

Replies to this question were received from eighty-nine departments. Of these, 20% indicated that there was no time limit imposed on post-doctoral appointments. This varied from a low of 9% in the physical sciences and the health sciences to a high of 40% in the humanities and social sciences. About 10% of the departments stated that they had a one-year time limit; one department in the health sciences, 20% of the departments in engineering, and 50% of the humanities and social sciences departments. A time limit of two years was imposed by over 50% of all the departments

TABLE 10

MAXIMUM LENGTH OF TIME POST-DOCTORALS MAY CONTINUE IN A DEPARTMENT AS REPORTED BY DEPARTMENTAL CHAIRMEN

(FIGURES IN PARENTHESIS ARE PER CENTS)

	TIME LIMIT					NO. of DEPARTMENTS REPORTING
	1 YEAR	2 YEARS	3 YEARS	5 YEARS	NO LIMIT	
HUMANITIES AND SOCIAL SCIENCES	5 (50.0)	1 (10.0)			4 (40.0)	10 (100.0)
PHYSICAL SCIENCES		25 (75.8)	4 (12.1)	1 (3.0)	3 (9.1)	33 (100.0)
MATHEMATICAL SCIENCES		2 (40.0)	2 (40.0)		1 (20.0)	5 (100.0)
ENGINEERING	3 (20.0)	7 (46.7)		1 (6.7)	4 (26.7)	15 (100.0)
LIFE SCIENCES		6 (40.0)	4 (26.7)		5 (33.3)	15 (100.0)
HEALTH SCIENCES	1 (9.1)	5 (45.4)	4 (36.4)		1 (9.1)	11 (100.0)
TOTAL	9 (10.1)	46 (51.7)	14 (15.7)	2 (2.3)	18 (20.2)	89 (100.0)

replying. This time limit was indicated by between 40 and 47% of the departments in the mathematical sciences, engineering, the life sciences and the health sciences. One department (10%) in the humanities and social sciences and 76% of the departments in the physical sciences imposed this time limit. A three-year time limit was indicated by 16% of the departments, the significant figures being 27% of the life sciences departments, 36% of the health sciences departments, and 40% of the mathematical sciences departments. One department in the physical sciences and one in engineering indicated a five-year time limit but for practical purposes this could be considered as no limit.

The departmental chairmen were asked (if in the previous question they had indicated that there was a time limit) if the time limit was a policy of the university. Sixty departments replied but only four stated that the time limit was university policy. Some confusion seems to exist however because in all four cases the majority of the departments in the same institutions had replied that no university policy existed. The departmental chairmen were also asked if the time limit depended on whether or not the student had had previous post-doctoral experience elsewhere. Sixty-five departments answered this question with only nine giving an affirmative reply. There does not appear to be any uniform policy in the Ontario universities regarding the duration of post-doctoral appointments.

Duration of Appointments

By way of comparison we will now look at the actual time spent by the students in post-doctoral studies. For those students who did not finish their appointments during the study period this will be the expected duration of their appointments. We have considered a post-doctoral appointment to be the time spent in post-PhD studies by a student in the same department at the same university. The post-doctorals were asked to

TABLE 11

EXPECTED DURATION OF POST-DOCTORAL APPOINTMENTS

(FIGURES IN PARENTHESES ARE PERCENTS)

	EXPECTED DURATION OF APPOINTMENT (MONTHS)													
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37 +	TOTAL
HUMANITIES AND SOCIAL SCIENCES			2 (13.3)	10 (66.7)			1 (6.7)	2 (13.3)						15 (100.0)
PHYSICAL SCIENCES	1 (0.3)	5 (1.7)	16 (5.5)	65 (22.4)	6 (2.1)	14 (4.8)	10 (3.5)	130 (44.8)	7 (2.4)	5 (1.7)	7 (2.4)	14 (4.8)	10 (3.5)	290 (100.0)
MATHEMATICAL SCIENCES		2 (7.1)	1 (3.6)	11 (39.3)	2 (7.1)		1 (3.6)	10 (35.7)				1 (3.6)		28 (100.0)
ENGINEERING			3 (5.1)	18 (30.5)	1 (1.7)	9 (15.3)	3 (5.1)	17 (28.8)			2 (3.4)	4 (6.8)	2 (3.4)	59 (100.0)
LIFE SCIENCES		2 (2.4)	2 (2.4)	13 (15.9)	5 (6.1)	9 (11.0)	5 (6.1)	31 (37.8)	2 (2.4)	3 (3.7)		6 (7.3)	4 (4.9)	82 (100.0)
HEALTH SCIENCES	1 (2.9)	1 (2.9)		5 (14.3)		2 (5.7)	1 (2.9)	15 (42.9)	2 (5.7)	2 (5.7)		6 (17.1)		35 (100.0)
TOTAL	2 (0.4)	10 (1.9)	24 (4.7)	122 (24.0)	14 (2.7)	34 (6.7)	21 (4.1)	205 (40.3)	11 (2.2)	10 (1.9)	9 (1.8)	31 (6.1)	16 (3.1)	509 (100.0)

indicate on their questionnaires when their appointments had begun and when they were expected to be terminated. The responses are presented in Table 11.

In the previous section it was seen that about half of the departments favoured a two-year appointment. It is not surprising therefore that about 40% of the post-doctoral students indicated that their appointments had lasted for about two years. A further 24% had appointments that lasted for about one year and 6% had a duration of about three years. Exactly 7% of the post-doctoral appointments had a duration of from one to nine months nearly 14% from thirteen to twenty-one months, 6% from twenty-five to thirty-three months, and 3% lasted more than three years. Nearly 85% of the appointments lasted two years or less. This would seem to reflect the policy of the two major external granting agencies, NRC and the Medical Research Council, during the period covered by this investigation. Both agencies award fellowships for one year with an option for a one-year renewal if satisfactory progress is reported.

There are some interesting differences between discipline groups. In Table 10 it was seen that 50% of the departmental chairmen in the humanities and social sciences felt that only one year of post-doctorate study was needed. Not surprisingly, 80% of the post-doctoral students in this discipline area had appointments that lasted from seven to twelve months. In the mathematical sciences approximately equal numbers of students had about one year and about two years of post-doctoral studies. The same was also true of engineering. In the physical sciences and the life sciences there were roughly twice as many students who had about two years of study as there were students who had one year. Health sciences was the only discipline to record a significant percentage of its students (17%) who held appointments that lasted for about three years.

Formal Instruction Taken by Post-doctoral Students

While the post-doctoral students appear to be primarily interested in doing research during their appointments, it would seem reasonable to expect a number of them to take advantage of the fact that they are at a new institution by taking some of the courses offered at the university. The students were asked to list on their questionnaires the time that they had spent during the year auditing any regular university courses. The results are shown in Table 12.

Only about one-quarter of the students (125) who returned the questionnaires have indicated that they attended any courses during the year. About 20% of the post-doctoral students in the humanities and social sciences took courses, 21% in the physical sciences, almost 80% in the mathematical sciences, 24% in engineering, 21% in the life sciences, and 23% in the health sciences. With the exception of the mathematical sciences, only 20 to 23% of the students in the other discipline areas considered it worthwhile to attend courses.

The normal teaching year extends over twenty-six weeks; thirteen weeks in both the fall term and in the winter term. One would also expect the majority of courses to be either one or two hours per week. We would therefore anticipate that the highest percentages would be found in the intervals in which multiples of thirteen occur. This is indeed the case, as 16% of the students auditing courses took from eleven to twenty hours of instruction, almost 22% took from twenty-one to thirty hours, over 10% from thirty-one to forty, and 19% from fifty-one to sixty hours. Only 17% of the post-doctorals auditing courses have shown more than sixty hours of formal instruction. It should be noted that fifty-two course-hours represents only two hours of classes for the twenty-six week teaching year. The largest groups of students in the physical sciences, the mathematical sciences and engineering received from twenty-one to thirty hours of formal

TABLE 12

COURSE HOURS AUDITED PER STUDENT
(FIGURES IN PARENTHESES ARE PERCENTS)

	COURSE HOURS												
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121 +	TOTAL
HUMANITIES AND SOCIAL SCIENCES					1 (33.3)	1 (33.3)					1 (33.3)			3 (100.0)
PHYSICAL SCIENCES	2 (3.3)	9 (14.7)	13 (21.3)	11 (18.0)	7 (11.5)	12 (19.7)	2 (3.3)	2 (3.3)		1 (1.6)			2 (3.3)	61 (100.0)
MATHEMATICAL SCIENCES	1 (4.6)	2 (9.1)	5 (22.7)		2 (9.1)	3 (13.6)	2 (9.1)	3 (13.6)	2 (9.1)	1 (4.6)			1 (4.6)	22 (100.0)
ENGINEERING	3 (21.4)		5 (35.7)	1 (7.1)	1 (7.1)	4 (28.6)								14 (100.0)
LIFE SCIENCES	1 (5.9)	6 (35.3)	2 (11.8)	1 (5.9)	1 (5.9)	3 (17.6)		2 (11.8)					1 (5.9)	17 (100.0)
HEALTH SCIENCES	1 (12.5)	3 (37.5)	2 (25.0)			1 (12.5)		1 (12.5)						8 (100.0)
TOTAL	8 (6.4)	20 (16.0)	27 (21.6)	13 (10.4)	12 (9.6)	24 (19.2)	4 (3.2)	8 (6.4)	2 (1.6)	2 (1.6)	1 (0.8)		4 (3.2)	125 (100.0)

instruction while the largest groups in the life sciences and the health sciences only received from eleven to twenty hours.

In general, it would seem that the post-doctoral students have not drawn heavily on the instructional resources of the Ontario universities. It is highly probable that those post-doctorals who audited courses attended regularly scheduled graduate classes. These classes are usually small in size and it is doubtful if the addition of a few post-doctoral students would significantly increase the instructional workload.

Contact With Academic Staff

We have seen that the post-doctoral students do not participate in formal classroom instruction to any significant degree. We will now examine the role of the academic staff, and in particular the mentor assigned to the student, during the period of post-doctoral study. The post-doctoral students were asked to indicate on their questionnaires the academic rank held by their mentors and the average number of hours per week that were spent in consultation with the mentors in connection with the post-doctoral research. Replies were received from 441 of the students and the results are presented in Table 13.

Only three academic ranks, professor, associate professor and assistant professor, were indicated as mentors by the post-doctoral students. Over 60% of the students had a full professor as their mentor, 27% had an associate professor, and 7% had an assistant professor. It is interesting to note that the average time spent in contact with the mentor increased as the academic rank of the mentor decreased. Those post-doctorals who had a full professor as their mentor spent three hours on the average each week in consultation. For those students with associate professors for mentors the weekly average was four and one-half hours and for those with assistant professors the figure was nearly five hours. The average for all three ranks was three and one-half hours per week.

TABLE 13

HOURS PER WEEK SPENT IN CONTACT WITH MENTORS

(FIGURES IN PARENTHESES ARE PERCENTS)

	ACADEMIC RANK OF MENTOR									
	PROFESSOR		ASSOCIATE PROFESSOR		ASSISTANT PROFESSOR		NOT INDICATED		TOTAL	
	NO. OF P-D s	AVERAGE HRS/WK.	NO. OF P-D s	AVERAGE HRS/WK.	NO. OF P-D s	AVERAGE HRS/WK.	NO. OF P-D s	AVERAGE HRS/WK.	NO. OF P-D s	AVERAGE HRS/WK.
HUMANITIES AND SOCIAL SCIENCES	11 (84.6)	2.6	2 (15.4)	4.3					13 (100.0)	2.8
PHYSICAL SCIENCES	170 (65.1)	2.8	75 (28.7)	4.8	15 (5.7)	5.4	1 (0.4)	1.0	261 (100.0)	3.5
MATHEMATICAL SCIENCES	14 (82.4)	2.3	3 (17.6)	3.2					17 (100.0)	2.4
ENGINEERING	33 (66.0)	2.5	12 (24.0)	3.8	5 (10.0)	2.3			50 (100.0)	2.8
LIFE SCIENCES	48 (65.8)	3.6	19 (26.0)	4.2	6 (8.2)	3.6			73 (100.0)	3.7
HEALTH SCIENCES	17 (63.0)	4.2	6 (22.2)	4.3	3 (11.1)	10.0	1 (3.7)	1.0	27 (100.0)	4.7
TOTAL	293 (11.4)	3.0	117 (26.5)	4.5	29 (6.6)	4.9	2 (0.5)	1.0	441 (100.0)	3.5

In the mathematical sciences and the humanities and social sciences respectively, 82% and 85% of the post-doctoral students indicated that they had a full professor as mentor. The remaining students in these disciplines had associate professors for mentors. In the other four discipline areas 63 to 66% of the post-doctorals stated that their mentors were full professors and from 22 to 26% had associate professors. Students in the mathematical sciences spent the least time with their mentors (2.4 hours per week) while post-doctorals in the health sciences spent the most time in consultation (4.7 hours per week).

The post-doctoral students were also asked to indicate the number of hours per week that they spent on the average in consultation regarding their research with faculty members other than their mentors. Only 50% of the post-doctorals indicated that they had any such consultation; the results are shown in Table 14.

Over 73% of the students in the humanities and social sciences and 69% in the health sciences stated that they spent a certain number of hours each week discussing their research with faculty members other than their mentors. The corresponding figures for the other disciplines ranged from 42 to 50%. The 255 post-doctorals who responded to this question spent an average of 2.8 hours per week in consultation; students in the life sciences spent only 1.9 hours per week while students in the humanities and social sciences spent the most time (3.4 hours per week).

There is no evidence to indicate that the students who did not reply to this question had any significant amount of contact with faculty other than their mentors. Since this was the case for 50% of the post-doctoral students, it was decided to distribute the hours reported in Table 14 over all of the post-doctoral students and increment the average values reported in Table 13 to give the average number of hours per week that the students spent with the academic staff discussing their research. The results of

TABLE 14

HOURS PER WEEK SPENT IN CONTACT WITH FACULTY
(OTHER THAN MENTOR)

(FIGURES IN PARENTHESES ARE THE PERCENTS OF THE STUDENTS IN EACH DISCIPLINE AREA WHO ANSWERED THIS PART OF THE QUESTIONNAIRE)

	NO. OF P-D S	AVERAGE HRS/WK.
HUMANITIES AND SOCIAL SCIENCES	11 (73.3)	3.4
PHYSICAL SCIENCES	141 (48.5)	2.9
MATHEMATICAL SCIENCES	14 (50.0)	2.0
ENGINEERING	25 (42.4)	3.3
LIFE SCIENCES	40 (48.8)	1.9
HEALTH SCIENCES	24 (68.6)	3.0
TOTAL	255 (50.0)	2.8

this showed that the post-doctoral students spent an average of 4.9 hours per week in consultation with faculty. The figures for the discipline areas are 5.3 hours per week in the humanities and social sciences, 4.9 hours per week in the physical sciences, 3.4 hours per week in the mathematical sciences, 4.2 hours per week in engineering, 4.4 hours per week in the life sciences, and 6.7 hours per week in the health sciences. This would seem to indicate that there is a considerable exchange of ideas and opinions between post-doctoral students and the faculty in the Ontario universities.

Teaching Duties of the Post-doctoral Students

Post-doctoral students constitute a source of highly qualified manpower and it would seem very likely that the universities would make use of this resource. To learn if this was indeed taking place we asked the post-doctorals to list on their questionnaires any teaching responsibilities that they held during the academic year 1969-70. The responses are presented in Table 15.

It is interesting to note that only 177 post-doctoral students, or 35% of the total were engaged in instructional activities. Looking at the discipline areas, the percentages of the students who had teaching duties are 23% in the health sciences, 25% in the life sciences, 32% in engineering, 36% in the physical sciences, 53% in the humanities and social sciences, and 61% in the mathematical sciences. While nearly two-thirds of the post-doctoral students were not engaged in teaching, those who were averaged 129 hours during the year. This ranged from a low of 75 hours for students in the mathematical sciences to a high of 283 hours for post-doctorals in the health sciences. In the humanities and social sciences nearly 36% of the teaching time of the post-doctorals was devoted to undergraduate seminars. Exactly 71% of the teaching in the physical sciences was distributed over undergraduate seminars, undergraduate laboratories, and graduate student supervision. In the mathematical sciences over 50% of the teaching done by

TABLE 15

TEACHING DUTIES OF THE POST-DOCTORAL STUDENTS

(FIGURES IN PARENTHESES ARE PERCENTS)

	TEACHING DUTIES (HOURS PER YEAR)										
	LECTURES		SEMINARS		LABORATORIES		GRADUATE STUDENT SUPERVISION	OTHER	TOTAL	NUMBER OF POST-DOCTORAL STUDENTS	AVERAGE HOURS PER POST-DOCTORAL STUDENT
	UNDER-GRADUATE	GRADUATE	UNDER-GRADUATE	GRADUATE	UNDER-GRADUATE	GRADUATE					
HUMANITIES AND SOCIAL SCIENCES	216 (12.9)	26 (1.5)	598 (35.8)	205 (12.3)	150 (9.0)			475 (28.4)	1,670 (100.0)	8	209
PHYSICAL SCIENCES	912 (7.3)	257 (2.1)	2,706 (21.6)	1,035 (8.3)	3,465 (27.7)	814 (6.5)	2,709 (21.7)	604 (4.8)	12,502 (100.0)	104	120
MATHEMATICAL SCIENCES	689 (54.4)	116 (9.2)	123 (9.7)	75 (5.9)	24 (1.9)			240 (18.9)	1,267 (100.0)	17	75
ENGINEERING	92 (4.0)	149 (6.5)	302 (13.2)	116 (5.1)	616 (26.9)	26 (1.1)	529 (23.1)	458 (20.0)	2,288 (100.0)	19	120
LIFE SCIENCES	148 (5.1)		51 (1.7)	204 (7.0)	896 (30.7)	431 (14.8)	753 (25.8)	438 (15.0)	2,921 (100.0)	21	139
HEALTH SCIENCES			46 (2.0)	92 (4.1)	330 (14.6)		1,740 (77.0)	52 (2.3)	2,260 (100.0)	8	283
TOTAL	2,057 (9.0)	548 (2.4)	3,826 (16.7)	1,727 (7.5)	5,481 (23.9)	1,271 (5.5)	5,731 (25.0)	2,267 (10.0)	22,908 (100.0)	177	129

post-doctoral students was in undergraduate lectures. In engineering and the life sciences the highest percentages were in undergraduate laboratories and graduate supervision, while in the health sciences 77% of the teaching time of the post-doctorals was spent in supervising graduate students.

It would seem that the post-doctoral students performed a considerable teaching service for the universities; the actual monetary replacement value of this teaching will be looked at in the next chapter.

Importance of Post-doctoral Experience in Hiring

We have seen in the previous chapter that a substantial number of doctorate recipients have felt that post-doctoral experience is needed to obtain suitable academic employment. To determine if this viewpoint is shared by the departmental chairmen, who have the responsibility of hiring new academic staff, we asked them if they thought that post-doctoral experience was essential, advantageous, or not important in hiring new staff. Replies were received from ninety-four departments, but in some cases more than one category had been indicated. When this was done the choices were given equal weights and the appropriate fraction (either one-half or one-third) was entered in the indicated categories. The resulting tabulation is presented in Table 16.

The results clearly show that there is a definite benefit in having post-doctoral experience. Nearly 71% of the chairmen's responses indicated that it was advantageous and a further 26% considered it essential. Only 3% felt that post-doctoral experience was not important. Almost 82% of the chairmen in the humanities and social sciences indicated that they considered post-doctoral experience advantageous and the remaining two chairmen felt it was not important. In the physical sciences over one-half of the chairmen considered it essential. All of the chairmen in the mathematical sciences considered it advantageous to have post-PhD experience as did 93% of the engineering departmental chairmen. Somewhat similar

TABLE 16

IMPORTANCE OF POST-DOCTORAL EXPERIENCE IN HIRING NEW STAFF AS REPORTED BY DEPARTMENTAL CHAIRMEN
(FIGURES IN PARENTHESES ARE PERCENTS)

	ESSENTIAL	ADVANTAGEOUS	NOT IMPORTANT	NO. OF DEPARTMENTS REPORTING
HUMANITIES AND SOCIAL SCIENCES		9 (81.8)	2 (18.2)	11 (100.0)
PHYSICAL SCIENCES	18.5 (52.9)	16.5 (47.1)		35 (100.0)
MATHEMATICAL SCIENCES		6 (100.0)		6 (100.0)
ENGINEERING		13 (92.9)	1 (7.1)	14 (100.0)
LIFE SCIENCES	3 (18.7)	13 (81.3)		16 (100.0)
HEALTH SCIENCES	3 (25.0)	9 (75.0)		12 (100.0)
TOTAL	24.5 (26.1)	66.5 (70.7)	3 (3.2)	94 (100.0)

TABLE 17

ACADEMIC RANK AT WHICH FACULTY MEMBERS OF THE SAME PROFESSIONAL EXPERIENCE AS THE CURRENT POST-DOCTORALS ARE HIRED AS REPORTED BY DEPARTMENTAL CHAIRMEN

	INSTRUCTOR	LECTURER	ASSISTANT PROFESSOR	ASSOCIATE PROFESSOR	NO. OF DEPARTMENTS REPORTING
HUMANITIES AND SOCIAL SCIENCES	1.0	2.5	6.5	1.0	11
PHYSICAL SCIENCES	1.5	7.5	26.0		35
MATHEMATICAL SCIENCES		0.5	5.5		6
ENGINEERING		3.0	12.0		15
LIFE SCIENCES		3.5	12.5		16
HEALTH SCIENCES	1.0	2.5	8.5		12
TOTAL	3.5	19.5	71.0	1.0	95

patterns were exhibited in the life sciences and the health sciences with the majority of the chairmen indicating that post-doctoral experience was advantageous and the remaining chairmen indicating that it was essential. The departmental chairmen's responses clearly substantiate the feelings of the post-doctoral students in respect to the importance of the post-PhD studies.

The departmental chairmen were also asked to indicate at what academic rank faculty members with the same professional experience as the current post-doctorals would have been hired. Ninety-five chairmen replied and the responses were tabulated in a manner similar to the preceding table; the results are presented in Table 17. Almost 75% of the responses indicated that faculty members would have been hired at the level of assistant professor and a further 21% indicated that they would have been given the rank of lecturer.

In this chapter we have looked at the relationship between the post-doctoral students and the Ontario universities. In Chapter 3 we will examine the costs of post-doctoral education, the distribution of these costs among the various supporting agencies, and the financial benefits and costs to the students.

Chapter 3

The Financing of Post-doctoral Education

Ultimately, most activities in our modern world have a price tag affixed to them and education is no exception. Governments and the tax-paying public have become increasingly concerned over the enormous expenditures required in recent years to support public education. It is therefore necessary to examine the costs of post-doctoral education in the Ontario universities. We will begin this analysis by looking at the monetary rewards and losses of the post-doctoral students themselves.

Post-doctoral Stipends

By the time a graduate student has completed his PhD studies he will probably have spent at least eight to ten years at university. During much of this time his annual income at best will only have covered his basic living expenses and the costs of his education. Furthermore, a number of these students will be married and have families. One might expect that a level of support higher than that received during the doctoral training must be offered by the universities and granting agencies if PhD holders are to be induced to remain in the university and undertake post-doctoral studies.

To determine actual levels of support the post-doctoral students were asked to list on their questionnaires the annual amounts of any stipends, awarded salaries, fellowships or payments for teaching that they had received during the academic year 1969-70 as well as the granting agencies in each case. Replies were received from 490 of the 510 post-doctorals; the tabulated results are shown in Table 18.

In 1969-70 the average value of the annual stipend paid to post-doctoral students was $7,335. At first this may not appear to have been overly generous but it should be pointed out that there were tax benefits for many students. Many of the fellowships were awarded on a tax-free basis

TABLE 18

DISTRIBUTION OF POST-DOCTORAL STIPENDS

(FIGURES IN PARENTHESES ARE PERCENTS)

	VALUE OF STIPEND (DOLLARS/ANNUM)												
	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	8000-8999	9000-9999	10,000-10,999	11,000-11,999	12,000-12,999	13,000 14,000	TOTAL	AVERAGE STIPEND
HUMANITIES AND SOCIAL SCIENCES				4 (26.7)	2 (13.3)	3 (20.0)	2 (13.3)	3 (20.0)		1 (6.7)		15 (100.0)	8633
PHYSICAL SCIENCES	3 (1.1)	3 (1.1)	7 (2.5)	120 (42.1)	105 (36.8)	35 (12.3)	4 (1.4)	5 (1.7)	1 (0.4)	2 (0.7)		285 (100.0)	7209
MATHEMATICAL SCIENCES			1 (3.8)	9 (34.6)	8 (30.8)	1 (3.8)		4 (15.4)	2 (7.7)	1 (3.8)		26 (100.0)	8077
ENGINEERING	2 (3.9)	3 (5.9)	3 (5.9)	19 (37.2)	14 (27.4)	2 (3.9)	1 (2.0)	3 (5.9)	3 (5.9)		1 (2.0)	51 (100.0)	7284
LIFE SCIENCES	1 (1.3)	2 (2.5)	4 (5.1)	27 (34.2)	29 (36.7)	9 (11.4)	4 (5.1)	1 (1.3)	1 (1.3)	1 (1.3)		79 (100.0)	7297
HEALTH SCIENCES			1 (2.9)	13 (38.2)	14 (41.2)	4 (11.8)	1 (2.9)				1 (2.9)	34 (100.0)	7412
TOTAL	6 (1.2)	8 (1.6)	16 (3.3)	192 (39.2)	172 (35.1)	54 (11.0)	12 (2.5)	16 (3.3)	7 (1.4)	5 (1.0)	2 (0.4)	490 (100.0)	7335

but the final interpretation often rested with local taxation offices. (This situation has now changed. A bill was recently passed by the federal legislature removing tax exemptions previously enjoyed by many students receiving grants. Granting agencies may be hard pressed to increase the value of their grants to yield a level of support after deductions roughly equivalent to the level of support formerly received by the post-doctoral students. On the other hand, the value of the grants may in fact be increased but the granting agencies may be forced to reduce the total number of grants being offered. A large infusion of additional monies would be required if either of these contingencies are to be prevented.)

Turning again to Table 18, it is interesting to note that post-doctorals in the humanities and social sciences received the highest stipends, the average value being $8,633. Students in the mathematical sciences were next with an average of $8,077, and students in the physical sciences received the lowest stipends with an average value of $7,209. Not surprisingly, the majority of students in all discipline areas received stipends in the range $6,000 to $9,000. However, a substantial percentage of students in the humanities and social sciences and in the mathematical sciences received stipends in the range $10,000 to $11,000 which would account for the higher averages in these discipline areas.

The total value of the stipend is not the only criterion that we must examine in determining its attractiveness. We should also look at its relationship to academic salaries in the province. Table 19 presents the average salaries and average compensation for ranked academic staff in the Ontario Universities (excluding staff in the Faculties of Medicine).

In Chapter 2 we saw that, according to the departmental chairmen, post-doctoral students have qualifications similar to new staff at the ranks of lecturer and assistant professor. While starting salaries in

TABLE 19

AVERAGE SALARIES OF FULL-TIME ACADEMIC STAFF
IN ONTARIO UNIVERSITIES 1969-70
(EXCLUDING MEDICINE)

RANK	AVERAGE SALARY[1]	AVERAGE COMPENSATION[2]
PROFESSOR	20,841	22,533
ASSOCIATE PROFESSOR	15,273	16,513
ASSISTANT PROFESSOR	12,076	13,057
LECTURER	9,918	10,723
INSTRUCTOR	8,312	8,987
TOTAL	14,400	15,569

1. Source: 1969-70 UA1 anticipated actual submissions to the Department of University Affairs

2. Average salary figures have been increased by 8.12%. This value for fringe benefits was derived from the DBS/CAUBO forms and represents the average value for academic and support staff in the academic departments.

these two ranks would have been somewhat lower than the average salary figures shown the average values will serve for our comparison. The stipends of those students who enjoyed tax exemptions probably compared favourably with the average salaries of lecturers and assistant professors. However, for many students considerable income would have been given up by taking the post-doctoral appointment.

Sources of Stipends

The annual values of the stipends reported by the post-doctoral students (see Table 18) were reduced in some cases to reflect the actual number of months during the academic year 1969-70 that these students held their appointments and would have received payments. The figures have been grouped according to funding agency and are shown in Table 20. Two of the categories require a note of explanation. In some cases students reported the total monies received and listed more than one granting agency but gave no indication of what portion of the total had been awarded by each agency. The category "host university and other sources" has been used to record those cases where multiple sources were shown, one of which was the university at which the appointment was being taken, but no breakout between funding sources was given. The category "other multiple sources" was used for all other cases of multiple funding in which the distribution of monies from each granting agency was not specified.

Of the 2.7 million dollars paid in stipends to the Ontario post-doctoral students nearly half came from the National Research Council. This is not surprising considering the heavy concentration of students in the science-oriented disciplines. The next largest source of funds were the universities themselves; they accounted for over 18% of the total stipend monies. The only other major funding agency was the Medical Research Council (9% of the total) which contributed heavily to the support of students in the life sciences and the health sciences.

TABLE 20

SOURCES OF POST-DOCTORAL STIPENDS

(FIGURES IN PARENTHESES ARE PERCENTS)

TOTAL STIPENDS PAID (DOLLARS)

	NATIONAL RESEARCH COUNCIL	MEDICAL RESEARCH COUNCIL	CANADA COUNCIL	DEFENSE RESEARCH BOARD	OTHER FEDERAL AGENCIES	PROVINCIAL GOVERNMENT	FOREIGN GOVERNMENT	NON-PROFIT ORGANIZATION	INDUSTRY	RESEARCH GRANT	HOST UNIVERSITY	HOST UNIVERSITY & OTHER SOURCES	OTHER MULTIPLE SOURCES	OTHER	TOTAL VALUE OF STIPENDS
HUMANITIES AND SOCIAL SCIENCES	15,800 (16.5)		6,867 (7.1)				8,000 (8.3)	7,667 (8.0)		8,000 (8.3)	38,168 (39.8)			11,500 (12.0)	96,002 (100.0)
PHYSICAL SCIENCES	888,970 (57.4)		24,825 (1.6)	29,025 (1.9)	21,300 (1.4)	2,833 (0.2)	23,940 (1.5)	3,000 (0.2)	17,700 (1.1)	43,075 (2.8)	282,528 (18.3)	111,456 (7.2)	23,758 (1.5)	75,250 (4.9)	1,547,660 (100.0)
MATHEMATICAL SCIENCES	111,150 (70.2)									7,917 (5.0)	39,383 (24.9)				158,450 (100.0)
ENGINEERING	123,317 (47.5)		4,500 (1.7)		19,495 (7.5)		4,230 (1.6)	7,200 (2.8)	18,625 (7.2)	5,000 (1.9)	65,253 (25.1)		6,000 (2.3)	6,000 (2.3)	259,620 (100.0)
LIFE SCIENCES	157,367 (34.6)	125,500 (27.6)	4,800 (1.0)	1,925 (0.4)	8,300 (1.8)	12,400 (2.7)	25,850 (5.7)	34,650 (7.6)	6,750 (1.5)	11,300 (2.5)	49,900 (11.0)	11,400 (2.5)		5,000 (1.1)	455,142 (100.0)
HEALTH SCIENCES		111,811 (60.5)			6,250 (3.4)		5,250 (2.8)	46,100 (24.9)			15,350 (8.3)				184,761 (100.0)
TOTAL	1,296,604 (48.0)	237,311 (8.9)	40,992 (1.5)	30,950 (1.1)	55,345 (2.0)	15,233 (0.6)	67,270 (2.5)	98,617 (3.6)	43,075 (1.6)	75,292 (2.8)	490,582 (18.2)	122,856 (4.5)	29,758 (1.1)	97,750 (3.6)	2,701,635 (100.0)

Almost 40% of the stipend funds in the humanities and social sciences came from the universities and an additional 17% came from the National Research Council. This situation was reversed in the physical sciences with almost 60% of the monies coming from NRC and a further 18% being contributed by the universities. The corresponding figures for the mathematical sciences were 70% and 25% from these same two sources. Nearly half of the stipend monies in engineering came from NRC, a quarter from the universities, and a further 15% from other government sources and industry. The pattern was significantly different in the life sciences with 35%, 28% and 11% of the monies being contributed by N.R.C., the Medical Research Council and the universities respectively. In the health sciences the universities accounted for only 8% of the stipend monies. The heavy contributors in this discipline area were the Medical Research Council and non-profit organizations with 60 and 25% of the total respectively. It can be seen from these figures that the universities are heavily dependent on outside agencies for support of their post-doctoral students.

Replacement Value of the Post-doctorals' Teaching Service

The departmental chairmen were asked to indicate how many full-time academic staff they would have needed to replace the teaching done by their post-doctoral students and the costs of these additional staff. Only thirty-one departments indicated that they would have required additional teaching staff; the resulting tabulation is shown in Table 21. A compilation of their replies indicated that sixty-five new staff would have been needed at a cost of eight hundred thousand dollars.

Not all of the teaching duties performed by the post-doctoral students would have been taken over by these additional members of staff. It is likely that some of the duties would have fallen to the other members of the academic staff.

TABLE 21

REPLACEMENT COST OF THE TEACHING SERVICE
OF POST-DOCTORAL STUDENTS

	NUMBER OF FACULTY	COST OF FACULTY	NO. OF DEPARTMENTS REPORTING
HUMANITIES AND SOCIAL SCIENCES	4.7	$ 58,200	5
PHYSICAL SCIENCES	36.0	446,000	14
MATHEMATICAL SCIENCES	11.0	120,800	2
ENGINEERING	3.0	32,500	3
LIFE SCIENCES	8.5	124,000	5
HEALTH SCIENCES	1.5	18,000	2
TOTAL	64.7	$799,500	31

Costs of Post-doctoral Education

It must be stated at the outset that any cost figures developed in this section will be only approximate values. Without a detailed cost study it has been necessary to estimate many of the expense components. Furthermore, only expenses that were paid out of the operating budgets of the universities have been considered. No data were available on capital expenditures incurred by the post-doctoral students. For this reason the total cost figures will probably be on the low side.

Data on operating expenditures in the Ontario universities were taken from the DBS/CAUBO forms submitted to the Department of University Affairs in October, 1970. (As there were no post-doctoral students at Laurentian University this institution is not included in the subsequent cost analysis.)

Before examining some of the costs associated with post-doctoral education it is necessary to calculate the number of full-time equivalent (FTE) post-doctoral students in the Ontario universities during 1969-70. From the post-doctoral questionnaires it was calculated that the 510 post-doctoral students were present for a total of 4,552 man-months during the year. It was estimated previously that there were actually 622 post-doctoral students in the universities during the same time period. Assuming that the students who returned questionnaires are a representative sample,

$$\text{Total man-months} = \frac{4,552 \times 622}{510} = 5,552$$

Assuming that a post-doctoral appointment is normally for the full 12-month period,

$$\text{Total FTE post-doctoral students} = \frac{5,552}{12} = 462.7$$

1) Costs of post-doctoral stipends

We will next look at the monies paid in stipends to the post-doctoral students and attempt to determine the portion of this that should be allocated to the universities. In Table 20 it was seen that a total of

$2,701,635 was paid out in stipends in 1969-70 to the 510 post-doctorals who returned questionnaires. These 510 students represent 4,552 man-months and therefore,

$$\text{FTE post-doctorals} = \frac{4,552}{12} = 379.3$$

$$\text{Average annual stipend} = \frac{\$2,701,635}{379.3} = \$7,123$$

To determine the portion of this amount that was contributed by the universities it is necessary to allocate a part of the $122,856 reported under the category "host university and other sources" to the universities. Many of the post-doctoral students who had received a portion of their stipend from their host university and the remainder from other sources did show the amounts that had been received from each source. A total of $620,741 was reported by students of which $205,055 (33.0%) came from the universities. Assuming that this percentage can also be applied to the $122,856, then the portion of the total stipends which were contributed by the universities becomes

$$\$490,582 + (\$122,856 \times 0.33) = \$531,124$$

This amount, expressed as a percentage of the total, is

$$\frac{\$531,124}{\$2,701,635} \times 100 = 19.7\%$$

Therefore, the portion of the average annual stipend which was contributed by the universities is

$$\$7,123 \times 0.197 = \$1,403$$

2) Costs of student services, central administration, miscellaneous non-academic and other academic expenses

The operating expenditures of the thirteen universities will now be examined to see what costs should be attributed to post-doctoral students. On the CAUBO forms the universities showed expenditures of $69,528,000 for student services, central administration, miscellaneous non-academic, and other academic expenses. It would seem reasonable that these costs should

be apportioned on a per FTE student basis. In these areas post-doctoral students (on the average) probably make the same demands on the university as the other students attending the university. According to final statistics produced by the Department of University Affairs, in 1969-70 there were 109,612 eligible FTE students. Adding to this the FTE post-doctoral students we have

Total FTE enrolment = 109,612 + 462.7 = 110,074.7

and the cost for the above services per FTE student is

$$\frac{\$69,528,000}{110,074.7} = \$632$$

3) Costs of library services

In 1969-70 the universities showed expenditures of $27,983,000 for library services. It was thought that library usage would be dependent on programme and level of programme and that the students should be weighted in some fashion. No system of weights based on library usage exists however; it was decided that the system of weights employed in the operating grants formula would be used as an approximation. Again according to the Department of University Affairs there were 191,044.3 weighted students in 1969-70. It was thought that the post-doctoral students should be given the same weight as PhD students (a weight of six) which gives

Total weighted enrolment = 191,044.3 + (462.7 x 6) = 193,820.5

The cost of library services per weighted student then becomes

$$\frac{\$27,983,000}{193,820.5} = \$144$$

This gives a cost per post-doctoral student of

$144 x 6 = $864

4) Costs of plant maintenance

It was thought that some system of weighting students should also be used in distributing plant maintenance costs. An interim capital formula

is in use in Ontario and it was decided to use this weighting scheme, again assigning the post-doctorals the same weight as PhD students (in this case a weight of four). In 1969-70 the total space entitlement for the thirteen universities was 12,004,000 net assignable square feet[15] which, when divided by the space allowance of 96 net assignable square feet per weighted student, gives a total of 125,041.6 weighted students. Adding in the post-doctoral students we have

Total weighted students $125,041.6 + 462.7 \times 4 = 126,892.4$

The capital formula however does not include health sciences space. It was therefore necessary to reduce the plant maintenance expenditures (as reported on the CAUBO forms) in proportion to the number of weighted students in the health sciences (using the weights of the operating grants formula). This resulted in plant maintenance expenditures of $41,242,678. The cost per weighted student is

$$\frac{\$41,242,678}{126,892.4} = \$325$$

The resulting cost per post-doctoral stuent becomes

$$\$325 \times 4 = \$1300$$

5) Costs of academic staff salaries

The post-doctoral students must also bear a portion of the costs of academic salaries. It is unlikely that they contributed significantly to formal instructional costs in the universities but they did spend considerable time in contact with the academic staff. We will first look at the cost of the time spent in contact with mentors. Using the distribution shown in Table 13 it is possible to calculate the weekly contact-hours for each academic rank. We can then compute the cost of the time spent with post-doctoral students for each academic rank using the following equation:

$$\text{Cost} = \frac{\text{Total Contact-Hours/Week}}{\text{Average Work Week}} \times \text{Annual Compensation}$$

Values for average compensation have been taken from Table 19 and figures

for the average work week were based on a study conducted at the University of Toronto in 1966.[16] (Studies in other jurisdictions have shown similar results.) The costs for each academic rank are calculated below:

Professor:	$\frac{866.6}{48.3}$ x $22,533 =	$404,287
Associate Professor:	$\frac{530.5}{46.6}$ x $16,513 =	$187,986
Assistant Professor:	$\frac{143.3}{45.3}$ x $13,057 =	$ 41,305
Not Indicated:	$\frac{2.0}{46.8}$ x $16,523 =	$ 706
Total		$634,284

In computing the value in the "not indicated" category weighted average values for the above three ranks were used. Assuming that the distribution shown in Table 12 can be applied to the 510 students who returned questionnaires, the total cost becomes

$$\$634,284 \times \frac{510}{441} = \$733,526$$

This value is based on the assumption that the post-doctorals were present for 510 x 12 = 6120 man-months; in actual fact the 510 students represented only 4552 man-months and the total cost is reduced to

$$\$733,526 \times \frac{4552}{6120} = \$545,590$$

The cost per post-doctoral student is then

$$\frac{\$545,590}{510} = \$1070$$

The post-doctoral students also indicated that they were in contact with faculty other than their mentors and a cost must be derived for this consultation. It will be assumed that faculty holding the ranks from lecturer to full professor were represented in this group; average values for annual compensation and average work week for this group were calculated. Using a figure for the total weekly contact-hours derived from Table 14, the total cost can now be found.

$$\text{Cost} = \frac{703.0}{46.3} \times \$15,763 = \$239,339$$

Assuming that this figure represents the cost for all 510 post-doctoral students, the cost per post-doctoral becomes

$$\$239,339 \times \frac{4552}{6120} \times \frac{1}{510} = \$349$$

The portion of academic salaries that must be allocated to each post-doctoral student is then

$$\$1070 + \$349 = \$1419$$

6) Value of post-doctoral teaching

Before the costs are added together it is necessary to derive a dollar value for the teaching performed by the post-doctoral students. In Table 21 it was seen that the departmental chairmen estimated that 64.7 additional staff would have been needed to replace the teaching done by post-doctoral students at a cost of $799,500. This represents an average salary of $12,363 which would seem to indicate that the replacement staff would have been lecturers, assistant professors, and associate professors. For these ranks the University of Toronto study showed an average work week of 45.41 hours of which 23.31 hours (51.3%) were devoted to all instructional duties. The actual replacement value of the post-doctoral teaching becomes

$$\$799,500 \times 0.513 = \$410,144$$

The value per FTE post-doctoral student is then

$$\frac{\$410,144}{462.7} = \$886$$

It is now possible to determine the net cost of post-doctoral education and the portion of this cost that is borne by the university.

7) Net cost of post-doctoral education

Stipends	$ 7,123
Student services, central administration, miscellaneous non-academic, other academic	632
Library services	864
Plant maintenance	1,300
Academic staff salaries	1,419
Total	$11,338
Less teaching service	886
Net Cost	$10,452

8) Net cost to the universities

This cost is determined by replacing the amount shown above under stipends with $1,403 which is the share contributed by the universities. This results in a net cost to the universities of $4,732 per post-doctoral student.

The net operating cost associated with post-doctoral education is $10,452 per student of which 45.3% on the average is contributed by the host university.

EPILOGUE

This study has presented a look at post-doctoral education in the Ontario universities in the year 1969-70. But important changes have taken place since then. NRC's decision to limit the number of its awards which may be held at universities outside of Canada will have drastic effects on the mix of the post-doctoral population. The level of support and the number of fellowships awarded may be greatly changed as a result of the decision to remove tax exemptions from grants. Recent indications that university enrolments have begun to level off[17] may seriously alter the employment prospects of PhD graduates and PhDs engaged in post-doctoral study.

In view of these changes, it would seem appropriate to suggest that a follow-up study is needed. Such a study is currently being undertaken for the academic year 1971-72 by O. H. Levine of the National Research Council as part of his larger study for the Tri-Council (NRC, MRC and Canada Council) on graduate education in Canada. It is expected that the results of this study will be available in the latter part of 1972.

Footnotes

1. Projections of Manpower Resources and Research Funds 1968-72, Forecasting Committee, National Research Council of Canada, Ottawa, 1969, p. 46

2. Survey of Scientific and Engineering Research and Manpower at Canadian Universities 1966-72, Program Planning and Analysis Section, National Research Council of Canada, Ottawa, February 1970

3. Sources: Unpublished data prepared by the Department of University Affairs, September, 1969 and May, 1971

4. Sources: Briefs of the Ontario universities submitted to the Committee on University Affairs, September to December, 1970

5. The Invisible University, National Academy of Sciences, Washington, D.C., 1969

6. Ibid p. 64-65

7. Ibid p. 192

8. Survey of Citizenship of Graduate Students Enrolled in Master's and Doctoral Degree Programmes at Ontario Universities in 1969-70, Committee of Presidents of Universities of Ontario, Toronto, 1970

9. L.C. Payton, Canadians Engaged in Post-doctoral Studies in Other Countries 1969-70, Council of Ontario Universities, Toronto, 1972

10. Annual Report on Support of University Research 1969-70, National Research Council of Canada, Ottawa, p. 21

11. Ibid, p. 394

12. Report of the President 1970-71, National Research Council of Canada, Ottawa, p. 62

13. Survey of Employment of Ontario PhD Graduates - 1964-69, Ontario Council on Graduate Studies, Toronto, 1970

14. Supplement #1 to Survey of Employment of Ontario PhD Graduates - 1964-69, Ontario Council on Graduate Studies, Toronto, 1971

15. Report of the Committee on University Affairs of Ontario 1969-70, Committee on University Affairs, Toronto, 1970, p. 35

16. B.L. Hansen and S. Sandler, Report on a Study of Faculty Activities at the University of Toronto, Office of Institutional Research, University of Toronto, Toronto, 1967

17. H. McIntyre, It Had to Come: College Enrolments Level Off, Financial Post, October 2, 1971

APPENDIX A

Questionnaires

ONTARIO COUNCIL ON GRADUATE STUDIES
STUDY OF POSTDOCTORAL EDUCATION IN ONTARIO

DEPARTMENTAL QUESTIONNAIRE

Institution _____ Department _____

This questionnaire is to be completed by all departments having postdoctoral students or research associates during the period from July 1, 1969, to June 30, 1970. The questionnaire should be filled out by the departmental chairman, or by a person designated by him, in consultation with the staff members of the department who are acting as mentors to the postdoctoral students. The last column of pages 2 and 3 of this questionnaire should be completed in consultation with the Physical Plant Department or space liaison officer.

1. Of the postdoctorals in your department, how many for their highest degree

   (a) Have the Ph.D. or equivalent? _____

   (b) Have the M.D. or equivalent? _____

   Of those in (b) how many are doing research as part of their residency training? _____

2. How do you rate the importance of postdoctoral experience in hiring new staff?

   [ ] Essential [ ] Advantageous [ ] Not Important

3. At what academic rank are faculty members of the same professional experience as your current postdoctorals hired?

   [ ] Instructor [ ] Lecturer [ ] Assistant Professor [ ] Associate Professor

4. (a) How long may an individual continue in your department as a postdoctoral? _____

   (b) If there is a limit is this a university policy?

   [ ] Yes [ ] No

   Does it depend on whether or not the postdoctoral has had postdoctoral experience elsewhere?

   [ ] Yes [ ] No

5. Of the postdoctoral students who finished their appointments during the last 12 months, how many found employment in each of the following categories?

   University or college _____ Business or industry _____

   Federal or provincial government _____ Non-profit organization _____

   Self-employment _____

   Continuing postdoctoral work at another institution _____

   Not known _____

6. Of the postdoctorals in Question 5 how many went to the following countries?

   Remained in Canada _____ U.S.A. _____

   United Kingdom _____ Europe _____

   Asia _____ Africa _____

   Other _____ Not known _____

7. How many full-time faculty would you need and at how much cost to replace the teaching service of your present postdoctorals?

   Number of Faculty _____ Total Cost _____

Continued on Page 2

DEPARTMENTAL QUESTIONNAIRE - Page 2

8. List all the rooms that are used as offices by the postdoctorals in your department:

Room Number	Persons Using This Room as an Office		NASF of Office Space#
	Postdoctoral	Other	

To be completed in consultation with the Physical Plant Department or space liaison officer.

Continued on Page 3

DEPARTMENTAL QUETIONNAIRE - Page 3

8. List all the rooms that are used as offices by the postdoctorals in your department:

Room Number	Persons Using This Room a Research Laboratory			NASF of Laboratory Space #
	Faculty	Postdoctorals	Graduate Students	

To be completed in consultation with the Physical Plant Department or space liaison officer.

ONTARIO COUNCIL ON GRADUATE STUDIES

STUDY OF POSTDOCTORAL EDUCATION IN ONTARIO

Physical Plant Information

Institution _____

To be completed by the Graduate Dean in consultation with the Director of Physical Plant or space liaison officer.

Please complete the following questions regarding the net assignable square feet of space at your university (including space assigned to the Health Sciences departments, if applicable) in accordance with the format of the Taylor, Lieberfeld and Heldman survey.

1. What is the total number of net assignable square feet of space at the university?

   _____

2. What is the total number of net assignable square feet of space at the university devoted to graduate student offices? This is the space designated by the TLH code 32000.

   _____

3. What is the total number of net assignable square feet of space at the university devoted to research laboratories used by graduate students, postdoctoral students and research associates?

   _____

ONTARIO COUNCIL ON GRADUATE STUDIES
STUDY OF POSTDOCTORAL EDUCATION IN ONTARIO

POSTDOCTORAL QUESTIONNAIRE

To be completed by all persons holding a postdoctoral or research associate appointment during the period from July 1,1969, to June 30, 1970. Some of these questions may require consultation with your mentor or supervisor before answering.

PLEASE TYPE OR PRINT YOUR ANSWERS

THIS IS A TWO PAGE QUESTIONNAIRE: BE SURE TO COMPLETE BOTH PAGES.

1. For each undergraduate and graduate degree list:

Institution & Location	Degree Received	Year Degree Received	Field of Study

2. For each previous postdoctoral appointment list:

Institution & Location	Period of Appointment Years: From	To	Field of Study

3. Present postdoctoral appointment:

(a) Institution_____ (b) Field of Study_____

(c) Department_____

(d) When did this appointment begin? (month, year)_____

(e) When do you expect it to terminate? (month, year)_____

4. Did you audit any regular courses during this past year?

[ ] Yes [ ] No

If yes, for each course audited list:

Hours /Week	No. of weeks course was audited during the last 12 Months

5. Sources of income: List all annual stipends (or awarded salaries, fellowships, or payments for teaching) and the granting agencies:

Amount	Granting Agency or Employer

6. Contact with faculty:

(a) How many hours per week do you spend consulting with your mentor regarding your research? _____

(b) What is his academic rank: _____

(c) On the average, with how many other faculty members and for how many hours/week are you in contact regarding your research?

Number of Faculty _____ Total Hours per Week _____

Continued on next page ....

POSTDOCTORAL QUESTIONNAIRE - PAGE 2

7. Teaching Duties:

		Number of Courses	Number of Students	Average Hours per Week	Average Number of Weeks per Academic Year
Course Lectures#	Undergr.				
	Graduate				
Seminars, Tutorials or Individual Instruction#	Undergr.				
	Graduate				
Laboratory Supervision	Undergr.				
	Graduate				
Assistance in Formal Graduate Supervision					
Other Departmental Duties					

Given on a weekly basis.

8. In which of the following types of organizations would you like to be employed after your present postdoctoral work?

[ ] University or college [ ] Federal or provincial government

[ ] Business or industry [ ] Non-profit organization

[ ] Self-employed

[ ] Other (specify) _____

9. What are your main reasons for taking this postdoctoral appointment?

_____

_____

10. (a) Country of citizenship: [ ] Canada [ ] Other (specify) _____

(b) Visa status (if not a Canadian citizen):

[ ] Landed Immigrant [ ] Other

APPENDIX B

Departments Within Major Discipline Areas

Departments within Major
Discipline Areas

Humanities and Social Sciences:

East Asian Studies
Geography
International Affairs
Islamic Studies
Political Economy
Psychology

Physical Sciences:

Aerospace
Astronomy
Chemistry
Experimental Space Studies
Geology
Geophysics
Metallurgy & Materials Science
Physics
Soil Science

Mathematical Sciences:

Mathematics

Engineering:

Chemical
Civil
Electrical
Engineering Materials
Engineering Science
Industrial
Mechanical
Metallurgical

Life Sciences:

Animal Science
Biochemistry
Biology
Botany
Crop Science
Zoology

Health Sciences:

Bacteriology
Hygiene
Medical Biophysics
Medical Cell Biology
Nutrition
Paediatrics
Pathology
Pathological Chemistry
Pharmacology
Pharmacy
Physiology
Veterinary Microbiology